

Search for  $B \rightarrow J/\psi D$  Decays

- B. Aubert,<sup>1</sup> R. Barate,<sup>1</sup> D. Boutigny,<sup>1</sup> F. Couderc,<sup>1</sup> Y. Karyotakis,<sup>1</sup> J. P. Lees,<sup>1</sup> V. Poireau,<sup>1</sup> V. Tisserand,<sup>1</sup>  
 A. Zghiche,<sup>1</sup> E. Grauges,<sup>2</sup> A. Palano,<sup>3</sup> M. Pappagallo,<sup>3</sup> A. Pompili,<sup>3</sup> J. C. Chen,<sup>4</sup> N. D. Qi,<sup>4</sup> G. Rong,<sup>4</sup> P. Wang,<sup>4</sup>  
 Y. S. Zhu,<sup>4</sup> G. Eigen,<sup>5</sup> I. Ofte,<sup>5</sup> B. Stugu,<sup>5</sup> G. S. Abrams,<sup>6</sup> A. W. Borgland,<sup>6</sup> A. B. Breon,<sup>6</sup> D. N. Brown,<sup>6</sup>  
 J. Button-Shafer,<sup>6</sup> R. N. Cahn,<sup>6</sup> E. Charles,<sup>6</sup> C. T. Day,<sup>6</sup> M. S. Gill,<sup>6</sup> A. V. Gritsan,<sup>6</sup> Y. Groysman,<sup>6</sup>  
 R. G. Jacobsen,<sup>6</sup> R. W. Kadel,<sup>6</sup> J. Kadyk,<sup>6</sup> L. T. Kerth,<sup>6</sup> Yu. G. Kolomensky,<sup>6</sup> G. Kukartsev,<sup>6</sup> G. Lynch,<sup>6</sup>  
 L. M. Mir,<sup>6</sup> P. J. Oddone,<sup>6</sup> T. J. Orimoto,<sup>6</sup> M. Pripstein,<sup>6</sup> N. A. Roe,<sup>6</sup> M. T. Ronan,<sup>6</sup> W. A. Wenzel,<sup>6</sup> M. Barrett,<sup>7</sup>  
 K. E. Ford,<sup>7</sup> T. J. Harrison,<sup>7</sup> A. J. Hart,<sup>7</sup> C. M. Hawkes,<sup>7</sup> S. E. Morgan,<sup>7</sup> A. T. Watson,<sup>7</sup> M. Fritsch,<sup>8</sup> K. Goetzen,<sup>8</sup>  
 T. Held,<sup>8</sup> H. Koch,<sup>8</sup> B. Lewandowski,<sup>8</sup> M. Pelizaeus,<sup>8</sup> K. Peters,<sup>8</sup> T. Schroeder,<sup>8</sup> M. Steinke,<sup>8</sup> J. T. Boyd,<sup>9</sup>  
 J. P. Burke,<sup>9</sup> N. Chevalier,<sup>9</sup> W. N. Cottingham,<sup>9</sup> M. P. Kelly,<sup>9</sup> T. Cuhadar-Donszelmann,<sup>10</sup> C. Hearty,<sup>10</sup>  
 N. S. Knecht,<sup>10</sup> T. S. Mattison,<sup>10</sup> J. A. McKenna,<sup>10</sup> D. Thiessen,<sup>10</sup> A. Khan,<sup>11</sup> P. Kyberd,<sup>11</sup> L. Teodorescu,<sup>11</sup>  
 A. E. Blinov,<sup>12</sup> V. E. Blinov,<sup>12</sup> A. D. Bukan,<sup>12</sup> V. P. Druzhinin,<sup>12</sup> V. B. Golubev,<sup>12</sup> V. N. Ivanchenko,<sup>12</sup>  
 E. A. Kravchenko,<sup>12</sup> A. P. Onuchin,<sup>12</sup> S. I. Serednyakov,<sup>12</sup> Yu. I. Skovpen,<sup>12</sup> E. P. Solodov,<sup>12</sup> A. N. Yushkov,<sup>12</sup>  
 D. Best,<sup>13</sup> M. Bondioli,<sup>13</sup> M. Bruinsma,<sup>13</sup> M. Chao,<sup>13</sup> I. Eschrich,<sup>13</sup> D. Kirkby,<sup>13</sup> A. J. Lankford,<sup>13</sup> M. Mandelkern,<sup>13</sup>  
 R. K. Mommsen,<sup>13</sup> W. Roethel,<sup>13</sup> D. P. Stoker,<sup>13</sup> C. Buchanan,<sup>14</sup> B. L. Hartfiel,<sup>14</sup> A. J. R. Weinstein,<sup>14</sup>  
 S. D. Foulkes,<sup>15</sup> J. W. Gary,<sup>15</sup> O. Long,<sup>15</sup> B. C. Shen,<sup>15</sup> K. Wang,<sup>15</sup> L. Zhang,<sup>15</sup> D. del Re,<sup>16</sup> H. K. Hadavand,<sup>16</sup>  
 E. J. Hill,<sup>16</sup> D. B. MacFarlane,<sup>16</sup> H. P. Paar,<sup>16</sup> S. Rahatlou,<sup>16</sup> V. Sharma,<sup>16</sup> J. W. Berryhill,<sup>17</sup> C. Campagnari,<sup>17</sup>  
 A. Cunha,<sup>17</sup> B. Dahmes,<sup>17</sup> T. M. Hong,<sup>17</sup> A. Lu,<sup>17</sup> M. A. Mazur,<sup>17</sup> J. D. Richman,<sup>17</sup> W. Verkerke,<sup>17</sup> T. W. Beck,<sup>18</sup>  
 A. M. Eisner,<sup>18</sup> C. J. Flacco,<sup>18</sup> C. A. Heusch,<sup>18</sup> J. Kroeseberg,<sup>18</sup> W. S. Lockman,<sup>18</sup> G. Nesom,<sup>18</sup> T. Schalk,<sup>18</sup>  
 B. A. Schumm,<sup>18</sup> A. Seiden,<sup>18</sup> P. Spradlin,<sup>18</sup> D. C. Williams,<sup>18</sup> M. G. Wilson,<sup>18</sup> J. Albert,<sup>19</sup> E. Chen,<sup>19</sup>  
 G. P. Dubois-Felsmann,<sup>19</sup> A. Dvoretskii,<sup>19</sup> D. G. Hitlin,<sup>19</sup> I. Narsky,<sup>19</sup> T. Piatenko,<sup>19</sup> F. C. Porter,<sup>19</sup> A. Ryd,<sup>19</sup>  
 A. Samuel,<sup>19</sup> S. Yang,<sup>19</sup> R. Andreassen,<sup>20</sup> S. Jayatilleke,<sup>20</sup> G. Mancinelli,<sup>20</sup> B. T. Meadows,<sup>20</sup> M. D. Sokoloff,<sup>20</sup>  
 F. Blanc,<sup>21</sup> P. Bloom,<sup>21</sup> S. Chen,<sup>21</sup> W. T. Ford,<sup>21</sup> U. Nauenberg,<sup>21</sup> A. Olivas,<sup>21</sup> P. Rankin,<sup>21</sup> W. O. Ruddick,<sup>21</sup>  
 J. G. Smith,<sup>21</sup> K. A. Ulmer,<sup>21</sup> J. Zhang,<sup>21</sup> A. Chen,<sup>22</sup> E. A. Eckhart,<sup>22</sup> J. L. Harton,<sup>22</sup> A. Soffer,<sup>22</sup> W. H. Toki,<sup>22</sup>  
 R. J. Wilson,<sup>22</sup> Q. Zeng,<sup>22</sup> B. Spaan,<sup>23</sup> D. Altenburg,<sup>24</sup> T. Brandt,<sup>24</sup> J. Brose,<sup>24</sup> M. Dickopp,<sup>24</sup> E. Feltresi,<sup>24</sup>  
 A. Hauke,<sup>24</sup> V. Klose,<sup>24</sup> H. M. Lacker,<sup>24</sup> E. Maly,<sup>24</sup> R. Nogowski,<sup>24</sup> S. Otto,<sup>24</sup> A. Petzold,<sup>24</sup> G. Schott,<sup>24</sup>  
 J. Schubert,<sup>24</sup> K. R. Schubert,<sup>24</sup> R. Schwierz,<sup>24</sup> J. E. Sundermann,<sup>24</sup> D. Bernard,<sup>25</sup> G. R. Bonneau,<sup>25</sup> P. Grenier,<sup>25</sup>  
 S. Schrenk,<sup>25</sup> Ch. Thiebaut,<sup>25</sup> G. Vasileiadis,<sup>25</sup> M. Verderi,<sup>25</sup> D. J. Bard,<sup>26</sup> P. J. Clark,<sup>26</sup> W. Gradl,<sup>26</sup> F. Muheim,<sup>26</sup>  
 S. Playfer,<sup>26</sup> Y. Xie,<sup>26</sup> M. Andreotti,<sup>27</sup> V. Azzolini,<sup>27</sup> D. Bettoni,<sup>27</sup> C. Bozzi,<sup>27</sup> R. Calabrese,<sup>27</sup> G. Cibinetto,<sup>27</sup>  
 E. Luppi,<sup>27</sup> M. Negrini,<sup>27</sup> L. Piemontese,<sup>27</sup> A. Sarti,<sup>27</sup> F. Anulli,<sup>28</sup> R. Baldini-Ferroli,<sup>28</sup> A. Calcaterra,<sup>28</sup> R. de  
 Sangro,<sup>28</sup> G. Finocchiaro,<sup>28</sup> P. Patteri,<sup>28</sup> I. M. Peruzzi,<sup>28</sup> M. Piccolo,<sup>28</sup> A. Zallo,<sup>28</sup> A. Buzzo,<sup>29</sup> R. Capra,<sup>29</sup>  
 R. Contri,<sup>29</sup> M. Lo Vetere,<sup>29</sup> M. Macri,<sup>29</sup> M. R. Monge,<sup>29</sup> S. Passaggio,<sup>29</sup> C. Patrignani,<sup>29</sup> E. Robutti,<sup>29</sup>  
 A. Santroni,<sup>29</sup> S. Tosi,<sup>29</sup> S. Bailey,<sup>30</sup> G. Brandenburg,<sup>30</sup> K. S. Chaisanguanthum,<sup>30</sup> M. Morii,<sup>30</sup> E. Won,<sup>30</sup>  
 R. S. Dubitzky,<sup>31</sup> U. Langenegger,<sup>31</sup> J. Marks,<sup>31</sup> S. Schenk,<sup>31</sup> U. Uwer,<sup>31</sup> W. Bhimji,<sup>32</sup> D. A. Bowerman,<sup>32</sup>  
 P. D. Dauncey,<sup>32</sup> U. Egede,<sup>32</sup> J. R. Gaillard,<sup>32</sup> G. W. Morton,<sup>32</sup> J. A. Nash,<sup>32</sup> M. B. Nikolich,<sup>32</sup> G. P. Taylor,<sup>32</sup>  
 M. J. Charles,<sup>33</sup> G. J. Grenier,<sup>33</sup> U. Mallik,<sup>33</sup> A. K. Mohapatra,<sup>33</sup> J. Cochran,<sup>34</sup> H. B. Crawley,<sup>34</sup> V. Eges,<sup>34</sup>  
 W. T. Meyer,<sup>34</sup> S. Prell,<sup>34</sup> E. I. Rosenberg,<sup>34</sup> A. E. Rubin,<sup>34</sup> J. Yi,<sup>34</sup> N. Arnaud,<sup>35</sup> M. Davier,<sup>35</sup> X. Giroux,<sup>35</sup>  
 G. Grosdidier,<sup>35</sup> A. Höcker,<sup>35</sup> F. Le Diberder,<sup>35</sup> V. Lepeltier,<sup>35</sup> A. M. Lutz,<sup>35</sup> T. C. Petersen,<sup>35</sup> M. Pierini,<sup>35</sup>  
 S. Plaszczynski,<sup>35</sup> S. Rodier,<sup>35</sup> P. Roudeau,<sup>35</sup> M. H. Schune,<sup>35</sup> A. Stocchi,<sup>35</sup> G. Wormser,<sup>35</sup> C. H. Cheng,<sup>36</sup>  
 D. J. Lange,<sup>36</sup> M. C. Simani,<sup>36</sup> D. M. Wright,<sup>36</sup> A. J. Bevan,<sup>37</sup> C. A. Chavez,<sup>37</sup> J. P. Coleman,<sup>37</sup> I. J. Forster,<sup>37</sup>  
 J. R. Fry,<sup>37</sup> E. Gabathuler,<sup>37</sup> R. Gamet,<sup>37</sup> K. A. George,<sup>37</sup> D. E. Hutchcroft,<sup>37</sup> R. J. Parry,<sup>37</sup> D. J. Payne,<sup>37</sup>  
 C. Touramanis,<sup>37</sup> C. M. Cormack,<sup>38</sup> F. Di Lodovico,<sup>38</sup> C. L. Brown,<sup>39</sup> G. Cowan,<sup>39</sup> R. L. Flack,<sup>39</sup> H. U. Flaecher,<sup>39</sup>  
 M. G. Green,<sup>39</sup> P. S. Jackson,<sup>39</sup> T. R. McMahon,<sup>39</sup> S. Ricciardi,<sup>39</sup> F. Salvatore,<sup>39</sup> D. Brown,<sup>40</sup> C. L. Davis,<sup>40</sup>  
 J. Allison,<sup>41</sup> N. R. Barlow,<sup>41</sup> R. J. Barlow,<sup>41</sup> M. C. Hodgkinson,<sup>41</sup> G. D. Lafferty,<sup>41</sup> M. T. Naisbit,<sup>41</sup>  
 J. C. Williams,<sup>41</sup> C. Chen,<sup>42</sup> A. Farbin,<sup>42</sup> W. D. Hulsbergen,<sup>42</sup> A. Jawahery,<sup>42</sup> D. Kovalskyi,<sup>42</sup> C. K. Lae,<sup>42</sup>  
 V. Lillard,<sup>42</sup> D. A. Roberts,<sup>42</sup> G. Blaylock,<sup>43</sup> C. Dallapiccola,<sup>43</sup> S. S. Hertzbach,<sup>43</sup> R. Kofler,<sup>43</sup> V. B. Koptchev,<sup>43</sup>  
 T. B. Moore,<sup>43</sup> S. Saremi,<sup>43</sup> H. Staengle,<sup>43</sup> S. Willocq,<sup>43</sup> R. Cowan,<sup>44</sup> K. Koeneke,<sup>44</sup> G. Sciolla,<sup>44</sup> S. J. Sekula,<sup>44</sup>

F. Taylor,<sup>44</sup> R. K. Yamamoto,<sup>44</sup> H. Kim,<sup>45</sup> P. M. Patel,<sup>45</sup> S. H. Robertson,<sup>45</sup> A. Lazzaro,<sup>46</sup> V. Lombardo,<sup>46</sup>  
F. Palombo,<sup>46</sup> J. M. Bauer,<sup>47</sup> L. Cremaldi,<sup>47</sup> V. Eschenburg,<sup>47</sup> R. Godang,<sup>47</sup> R. Kroeger,<sup>47</sup> J. Reidy,<sup>47</sup>  
D. A. Sanders,<sup>47</sup> D. J. Summers,<sup>47</sup> H. W. Zhao,<sup>47</sup> S. Brunet,<sup>48</sup> D. Côté,<sup>48</sup> P. Taras,<sup>48</sup> B. Viaud,<sup>48</sup> H. Nicholson,<sup>49</sup>  
N. Cavallo,<sup>50,\*</sup> G. De Nardo,<sup>50</sup> F. Fabozzi,<sup>50,\*</sup> C. Gatto,<sup>50</sup> L. Lista,<sup>50</sup> D. Monorchio,<sup>50</sup> P. Paolucci,<sup>50</sup> D. Piccolo,<sup>50</sup>  
C. Sciacca,<sup>50</sup> M. Baak,<sup>51</sup> H. Bulten,<sup>51</sup> G. Raven,<sup>51</sup> H. L. Snoek,<sup>51</sup> L. Wilden,<sup>51</sup> C. P. Jessop,<sup>52</sup> J. M. LoSecco,<sup>52</sup>  
T. Allmendinger,<sup>53</sup> G. Benelli,<sup>53</sup> K. K. Gan,<sup>53</sup> K. Honscheid,<sup>53</sup> D. Hufnagel,<sup>53</sup> P. D. Jackson,<sup>53</sup> H. Kagan,<sup>53</sup>  
R. Kass,<sup>53</sup> T. Pulliam,<sup>53</sup> A. M. Rahimi,<sup>53</sup> R. Ter-Antonyan,<sup>53</sup> Q. K. Wong,<sup>53</sup> J. Brau,<sup>54</sup> R. Frey,<sup>54</sup> O. Igonkina,<sup>54</sup>  
M. Lu,<sup>54</sup> C. T. Potter,<sup>54</sup> N. B. Sinev,<sup>54</sup> D. Strom,<sup>54</sup> E. Torrence,<sup>54</sup> F. Coleccchia,<sup>55</sup> A. Dorigo,<sup>55</sup> F. Galeazzi,<sup>55</sup>  
M. Margoni,<sup>55</sup> M. Morandin,<sup>55</sup> M. Posocco,<sup>55</sup> M. Rotondo,<sup>55</sup> F. Simonetto,<sup>55</sup> R. Stroili,<sup>55</sup> C. Voci,<sup>55</sup> M. Benayoun,<sup>56</sup>  
H. Briand,<sup>56</sup> J. Chauveau,<sup>56</sup> P. David,<sup>56</sup> L. Del Buono,<sup>56</sup> Ch. de la Vaissière,<sup>56</sup> O. Hamon,<sup>56</sup> M. J. J. John,<sup>56</sup>  
Ph. Leruste,<sup>56</sup> J. Malcles,<sup>56</sup> J. Ocariz,<sup>56</sup> L. Roos,<sup>56</sup> G. Therin,<sup>56</sup> P. K. Behera,<sup>57</sup> L. Gladney,<sup>57</sup> Q. H. Guo,<sup>57</sup>  
J. Panetta,<sup>57</sup> M. Biasini,<sup>58</sup> R. Covarelli,<sup>58</sup> M. Pioppi,<sup>58</sup> C. Angelini,<sup>59</sup> G. Batignani,<sup>59</sup> S. Bettarini,<sup>59</sup> F. Bucci,<sup>59</sup>  
G. Calderini,<sup>59</sup> M. Carpinelli,<sup>59</sup> F. Forti,<sup>59</sup> M. A. Giorgi,<sup>59</sup> A. Lusiani,<sup>59</sup> G. Marchiori,<sup>59</sup> M. Morganti,<sup>59</sup> N. Neri,<sup>59</sup>  
E. Paoloni,<sup>59</sup> M. Rama,<sup>59</sup> G. Rizzo,<sup>59</sup> G. Simi,<sup>59</sup> J. Walsh,<sup>59</sup> M. Haire,<sup>60</sup> D. Judd,<sup>60</sup> K. Paick,<sup>60</sup> D. E. Wagoner,<sup>60</sup>  
J. Biesiada,<sup>61</sup> N. Danielson,<sup>61</sup> P. Elmer,<sup>61</sup> Y. P. Lau,<sup>61</sup> C. Lu,<sup>61</sup> J. Olsen,<sup>61</sup> A. J. S. Smith,<sup>61</sup> A. V. Telnov,<sup>61</sup>  
F. Bellini,<sup>62</sup> G. Cavoto,<sup>62</sup> A. D'Orazio,<sup>62</sup> E. Di Marco,<sup>62</sup> R. Faccini,<sup>62</sup> F. Ferrarotto,<sup>62</sup> F. Ferroni,<sup>62</sup> M. Gaspero,<sup>62</sup>  
L. Li Gioi,<sup>62</sup> M. A. Mazzoni,<sup>62</sup> S. Morganti,<sup>62</sup> G. Piredda,<sup>62</sup> F. Polci,<sup>62</sup> F. Safai Tehrani,<sup>62</sup> C. Voena,<sup>62</sup> S. Christ,<sup>63</sup>  
H. Schröder,<sup>63</sup> G. Wagner,<sup>63</sup> R. Waldi,<sup>63</sup> T. Adye,<sup>64</sup> N. De Groot,<sup>64</sup> B. Franek,<sup>64</sup> G. P. Gopal,<sup>64</sup> E. O. Olaiya,<sup>64</sup>  
F. F. Wilson,<sup>64</sup> R. Aleksan,<sup>65</sup> S. Emery,<sup>65</sup> A. Gaidot,<sup>65</sup> S. F. Ganzhur,<sup>65</sup> P.-F. Giraud,<sup>65</sup> G. Graziani,<sup>65</sup>  
G. Hamel de Monchenault,<sup>65</sup> W. Kozanecki,<sup>65</sup> M. Legendre,<sup>65</sup> G. W. London,<sup>65</sup> B. Mayer,<sup>65</sup> G. Vasseur,<sup>65</sup>  
Ch. Yéche,<sup>65</sup> M. Zito,<sup>65</sup> M. V. Purohit,<sup>66</sup> A. W. Weidemann,<sup>66</sup> J. R. Wilson,<sup>66</sup> F. X. Yumiceva,<sup>66</sup>  
T. Abe,<sup>67</sup> D. Aston,<sup>67</sup> R. Bartoldus,<sup>67</sup> N. Berger,<sup>67</sup> A. M. Boyarski,<sup>67</sup> O. L. Buchmueller,<sup>67</sup> R. Claus,<sup>67</sup>  
M. R. Convery,<sup>67</sup> M. Cristinziani,<sup>67</sup> J. C. Dingfelder,<sup>67</sup> D. Dong,<sup>67</sup> J. Dorfan,<sup>67</sup> D. Dujmic,<sup>67</sup> W. Dunwoodie,<sup>67</sup>  
S. Fan,<sup>67</sup> R. C. Field,<sup>67</sup> T. Glanzman,<sup>67</sup> S. J. Gowdy,<sup>67</sup> T. Hadig,<sup>67</sup> V. Halyo,<sup>67</sup> C. Hast,<sup>67</sup> T. Hryni'ova,<sup>67</sup>  
W. R. Innes,<sup>67</sup> S. Kazuhito,<sup>67</sup> M. H. Kelsey,<sup>67</sup> P. Kim,<sup>67</sup> M. L. Kocian,<sup>67</sup> D. W. G. S. Leith,<sup>67</sup> J. Libby,<sup>67</sup>  
S. Luitz,<sup>67</sup> V. Luth,<sup>67</sup> H. L. Lynch,<sup>67</sup> H. Marsiske,<sup>67</sup> R. Messner,<sup>67</sup> D. R. Muller,<sup>67</sup> C. P. O'Grady,<sup>67</sup> V. E. Ozcan,<sup>67</sup>  
A. Perazzo,<sup>67</sup> M. Perl,<sup>67</sup> B. N. Ratcliff,<sup>67</sup> A. Roodman,<sup>67</sup> A. A. Salnikov,<sup>67</sup> R. H. Schindler,<sup>67</sup> J. Schwiening,<sup>67</sup>  
A. Snyder,<sup>67</sup> A. Soha,<sup>67</sup> J. Stelzer,<sup>67</sup> J. Strube,<sup>54, 67</sup> D. Su,<sup>67</sup> M. K. Sullivan,<sup>67</sup> J. Va'vra,<sup>67</sup> S. R. Wagner,<sup>67</sup>  
M. Weaver,<sup>67</sup> W. J. Wisniewski,<sup>67</sup> M. Wittgen,<sup>67</sup> D. H. Wright,<sup>67</sup> A. K. Yarritu,<sup>67</sup> C. C. Young,<sup>67</sup> P. R. Burchat,<sup>68</sup>  
A. J. Edwards,<sup>68</sup> S. A. Majewski,<sup>68</sup> B. A. Petersen,<sup>68</sup> C. Roat,<sup>68</sup> M. Ahmed,<sup>69</sup> S. Ahmed,<sup>69</sup> M. S. Alam,<sup>69</sup>  
J. A. Ernst,<sup>69</sup> M. A. Saeed,<sup>69</sup> M. Saleem,<sup>69</sup> F. R. Wappler,<sup>69</sup> W. Bugg,<sup>70</sup> M. Krishnamurthy,<sup>70</sup> S. M. Spanier,<sup>70</sup>  
R. Eckmann,<sup>71</sup> J. L. Ritchie,<sup>71</sup> A. Satpathy,<sup>71</sup> R. F. Schwitters,<sup>71</sup> J. M. Izen,<sup>72</sup> I. Kitayama,<sup>72</sup> X. C. Lou,<sup>72</sup> S. Ye,<sup>72</sup>  
F. Bianchi,<sup>73</sup> M. Bona,<sup>73</sup> F. Gallo,<sup>73</sup> D. Gamba,<sup>73</sup> M. Bomben,<sup>74</sup> L. Bosisio,<sup>74</sup> C. Cartaro,<sup>74</sup> F. Cossutti,<sup>74</sup>  
G. Della Ricca,<sup>74</sup> S. Dittongo,<sup>74</sup> S. Grancagnolo,<sup>74</sup> L. Lanceri,<sup>74</sup> P. Poropat,<sup>74, †</sup> L. Vitale,<sup>74</sup> G. Vuagnin,<sup>74</sup>  
F. Martinez-Vidal,<sup>75</sup> R. S. Panvini,<sup>76, †</sup> Sw. Banerjee,<sup>77</sup> B. Bhuyan,<sup>77</sup> C. M. Brown,<sup>77</sup> D. Fortin,<sup>77</sup> K. Hamano,<sup>77</sup>  
R. Kowalewski,<sup>77</sup> J. M. Roney,<sup>77</sup> R. J. Sobie,<sup>77</sup> J. J. Back,<sup>78</sup> P. F. Harrison,<sup>78</sup> T. E. Latham,<sup>78</sup> G. B. Mohanty,<sup>78</sup>  
H. R. Band,<sup>79</sup> X. Chen,<sup>79</sup> B. Cheng,<sup>79</sup> S. Dasu,<sup>79</sup> M. Datta,<sup>79</sup> A. M. Eichenbaum,<sup>79</sup> K. T. Flood,<sup>79</sup> M. Graham,<sup>79</sup>  
J. J. Hollar,<sup>79</sup> J. R. Johnson,<sup>79</sup> P. E. Kutter,<sup>79</sup> H. Li,<sup>79</sup> R. Liu,<sup>79</sup> B. Mellado,<sup>79</sup> A. Mihalyi,<sup>79</sup> Y. Pan,<sup>79</sup> R. Prepost,<sup>79</sup>  
P. Tan,<sup>79</sup> J. H. von Wimmersperg-Toeller,<sup>79</sup> J. Wu,<sup>79</sup> S. L. Wu,<sup>79</sup> Z. Yu,<sup>79</sup> M. G. Greene,<sup>80</sup> and H. Neal<sup>80</sup>

(The BABAR Collaboration)

<sup>1</sup>Laboratoire de Physique des Particules, F-74941 Annecy-le-Vieux, France

<sup>2</sup>IFAE, Universitat Autònoma de Barcelona, E-08193 Bellaterra, Barcelona, Spain

<sup>3</sup>Università di Bari, Dipartimento di Fisica and INFN, I-70126 Bari, Italy

<sup>4</sup>Institute of High Energy Physics, Beijing 100039, China

<sup>5</sup>University of Bergen, Inst. of Physics, N-5007 Bergen, Norway

<sup>6</sup>Lawrence Berkeley National Laboratory and University of California, Berkeley, California 94720, USA

<sup>7</sup>University of Birmingham, Birmingham, B15 2TT, United Kingdom

<sup>8</sup>Ruhr Universität Bochum, Institut für Experimentalphysik 1, D-44780 Bochum, Germany

<sup>9</sup>University of Bristol, Bristol BS8 1TL, United Kingdom

<sup>10</sup>University of British Columbia, Vancouver, British Columbia, Canada V6T 1Z1

<sup>11</sup>Brunel University, Uxbridge, Middlesex UB8 3PH, United Kingdom

<sup>12</sup>Budker Institute of Nuclear Physics, Novosibirsk 630090, Russia

<sup>13</sup>University of California at Irvine, Irvine, California 92697, USA

<sup>14</sup>University of California at Los Angeles, Los Angeles, California 90024, USA

- <sup>15</sup>University of California at Riverside, Riverside, California 92521, USA  
<sup>16</sup>University of California at San Diego, La Jolla, California 92093, USA  
<sup>17</sup>University of California at Santa Barbara, Santa Barbara, California 93106, USA  
<sup>18</sup>University of California at Santa Cruz, Institute for Particle Physics, Santa Cruz, California 95064, USA  
<sup>19</sup>California Institute of Technology, Pasadena, California 91125, USA  
<sup>20</sup>University of Cincinnati, Cincinnati, Ohio 45221, USA  
<sup>21</sup>University of Colorado, Boulder, Colorado 80309, USA  
<sup>22</sup>Colorado State University, Fort Collins, Colorado 80523, USA  
<sup>23</sup>Universität Dortmund, Institut für Physik, D-44221 Dortmund, Germany  
<sup>24</sup>Technische Universität Dresden, Institut für Kern- und Teilchenphysik, D-01062 Dresden, Germany  
<sup>25</sup>Ecole Polytechnique, LLR, F-91128 Palaiseau, France  
<sup>26</sup>University of Edinburgh, Edinburgh EH9 3JZ, United Kingdom  
<sup>27</sup>Università di Ferrara, Dipartimento di Fisica and INFN, I-44100 Ferrara, Italy  
<sup>28</sup>Laboratori Nazionali di Frascati dell'INFN, I-00044 Frascati, Italy  
<sup>29</sup>Università di Genova, Dipartimento di Fisica and INFN, I-16146 Genova, Italy  
<sup>30</sup>Harvard University, Cambridge, Massachusetts 02138, USA  
<sup>31</sup>Universität Heidelberg, Physikalisches Institut, Philosophenweg 12, D-69120 Heidelberg, Germany  
<sup>32</sup>Imperial College London, London, SW7 2AZ, United Kingdom  
<sup>33</sup>University of Iowa, Iowa City, Iowa 52242, USA  
<sup>34</sup>Iowa State University, Ames, Iowa 50011-3160, USA  
<sup>35</sup>Laboratoire de l'Accélérateur Linéaire, F-91898 Orsay, France  
<sup>36</sup>Lawrence Livermore National Laboratory, Livermore, California 94550, USA  
<sup>37</sup>University of Liverpool, Liverpool L69 7ZE, United Kingdom  
<sup>38</sup>Queen Mary, University of London, E1 4NS, United Kingdom  
<sup>39</sup>University of London, Royal Holloway and Bedford New College, Egham, Surrey TW20 0EX, United Kingdom  
<sup>40</sup>University of Louisville, Louisville, Kentucky 40292, USA  
<sup>41</sup>University of Manchester, Manchester M13 9PL, United Kingdom  
<sup>42</sup>University of Maryland, College Park, Maryland 20742, USA  
<sup>43</sup>University of Massachusetts, Amherst, Massachusetts 01003, USA  
<sup>44</sup>Massachusetts Institute of Technology, Laboratory for Nuclear Science, Cambridge, Massachusetts 02139, USA  
<sup>45</sup>McGill University, Montréal, Quebec, Canada H3A 2T8  
<sup>46</sup>Università di Milano, Dipartimento di Fisica and INFN, I-20133 Milano, Italy  
<sup>47</sup>University of Mississippi, University, Mississippi 38677, USA  
<sup>48</sup>Université de Montréal, Laboratoire René J. A. Lévesque, Montréal, Quebec, Canada H3C 3J7  
<sup>49</sup>Mount Holyoke College, South Hadley, Massachusetts 01075, USA  
<sup>50</sup>Università di Napoli Federico II, Dipartimento di Scienze Fisiche and INFN, I-80126, Napoli, Italy  
<sup>51</sup>NIKHEF, National Institute for Nuclear Physics and High Energy Physics, NL-1009 DB Amsterdam, The Netherlands  
<sup>52</sup>University of Notre Dame, Notre Dame, Indiana 46556, USA  
<sup>53</sup>Ohio State University, Columbus, Ohio 43210, USA  
<sup>54</sup>University of Oregon, Eugene, Oregon 97403, USA  
<sup>55</sup>Università di Padova, Dipartimento di Fisica and INFN, I-35131 Padova, Italy  
<sup>56</sup>Universités Paris VI et VII, Laboratoire de Physique Nucléaire et de Hautes Energies, F-75252 Paris, France  
<sup>57</sup>University of Pennsylvania, Philadelphia, Pennsylvania 19104, USA  
<sup>58</sup>Università di Perugia, Dipartimento di Fisica and INFN, I-06100 Perugia, Italy  
<sup>59</sup>Università di Pisa, Dipartimento di Fisica, Scuola Normale Superiore and INFN, I-56127 Pisa, Italy  
<sup>60</sup>Prairie View A&M University, Prairie View, Texas 77446, USA  
<sup>61</sup>Princeton University, Princeton, New Jersey 08544, USA  
<sup>62</sup>Università di Roma La Sapienza, Dipartimento di Fisica and INFN, I-00185 Roma, Italy  
<sup>63</sup>Universität Rostock, D-18051 Rostock, Germany  
<sup>64</sup>Rutherford Appleton Laboratory, Chilton, Didcot, Oxon, OX11 0QX, United Kingdom  
<sup>65</sup>DSM/Dapnia, CEA/Saclay, F-91191 Gif-sur-Yvette, France  
<sup>66</sup>University of South Carolina, Columbia, South Carolina 29208, USA  
<sup>67</sup>Stanford Linear Accelerator Center, Stanford, California 94309, USA  
<sup>68</sup>Stanford University, Stanford, California 94305-4060, USA  
<sup>69</sup>State University of New York, Albany, New York 12222, USA  
<sup>70</sup>University of Tennessee, Knoxville, Tennessee 37996, USA  
<sup>71</sup>University of Texas at Austin, Austin, Texas 78712, USA  
<sup>72</sup>University of Texas at Dallas, Richardson, Texas 75083, USA  
<sup>73</sup>Università di Torino, Dipartimento di Fisica Sperimentale and INFN, I-10125 Torino, Italy  
<sup>74</sup>Università di Trieste, Dipartimento di Fisica and INFN, I-34127 Trieste, Italy  
<sup>75</sup>IFIC, Universitat de Valencia-CSIC, E-46071 Valencia, Spain  
<sup>76</sup>Vanderbilt University, Nashville, Tennessee 37235, USA  
<sup>77</sup>University of Victoria, Victoria, British Columbia, Canada V8W 3P6  
<sup>78</sup>Department of Physics, University of Warwick, Coventry CV4 7AL, United Kingdom

<sup>79</sup>University of Wisconsin, Madison, Wisconsin 53706, USA

<sup>80</sup>Yale University, New Haven, Connecticut 06511, USA

(Dated: February 7, 2008)

We report a search for  $B \rightarrow J/\psi D$  decays, based on a sample of  $124 \times 10^6 B\bar{B}$  events collected with the BABAR detector at the PEP-II storage ring of the Stanford Linear Accelerator Center.

No significant signal is found. We obtain upper limits on the branching fractions of  $1.3 \times 10^{-5}$  for  $B^0 \rightarrow J/\psi \bar{D}^0$  and  $1.2 \times 10^{-4}$  for  $B^+ \rightarrow J/\psi D^+$  at 90% confidence level.

PACS numbers: 13.25.Hw, 14.40.Nd

Measurements of the inclusive spectrum of charmonium mesons in  $B$  decays are in conflict with conventional expectations. The spectra of the momentum of the  $J/\psi$  mesons in the  $\Upsilon(4S)$  rest frame observed by CLEO [1] and by BaBar [2] (Fig. 1), compared with calculations using non-relativistic QCD (NRQCD) [3], show an excess at low momentum, corresponding to a branching fraction of approximately  $6 \times 10^{-4}$ . Various hypotheses have been proposed to explain this low-momentum excess.

Brodsy and Navarra [4] have suggested that the decay  $B \rightarrow J/\psi \Lambda \bar{p}$  [5], with the possible formation of a  $\Lambda\bar{p}$  bound state, could explain the CLEO result. The kinematic boundary of this structure corresponds to the case where the  $J/\psi$  recoils nearly monoenergetically in the  $B$  rest frame against a  $2 \text{ GeV}/c^2$  particle. The  $\Lambda\bar{p}$  state could be observed near or just below threshold. BABAR has searched for these decays and obtained an upper limit of  $2.6 \times 10^{-5}$  at 90% confidence level (C.L.) [6], too small to support the mechanism proposed in [4].

Decays to a  $J/\psi$  meson and a hybrid meson, i.e. a bound state of two quarks and a gluon, have been proposed [7, 8]. In this case the hybrid meson, possibly a ( $s\bar{d}g$ ) state, would need to have a mass of about  $2 \text{ GeV}/c^2$ . No experimental evidence has been found to support this

mechanism.

If  $B$  mesons were decaying to a narrow resonance and a  $J/\psi$  meson, the  $J/\psi$  meson would be monoenergetic in the  $B$  rest frame. Such peaks would appear smeared with an RMS of  $0.12 \text{ GeV}/c$  in Fig. 1, due to the motion of the  $B$  in the  $\Upsilon(4S)$  rest frame.

The presence of  $b\bar{u}c\bar{c}$  components (intrinsic charm) in the  $B$ -meson wave function has also been proposed. In that case the charmonium meson is obtained merely by dissociation when the  $b$  quark decays. Intrinsic charm was first introduced by Brodsy *et al.* [9] to explain an unexpectedly large cross-section for charmed-particle production in hadron collisions. Using the estimated amount of intrinsic charm in the proton as an input, Chang and Hou predict  $B \rightarrow J/\psi D(\pi)$  decays with branching fractions of the order of  $10^{-4}$  [10]. The dominant final state is expected to be  $B \rightarrow J/\psi D\pi$ , for which BABAR has reported an upper limit at 90% C.L. of  $5.2 \times 10^{-5}$  for  $B^+ \rightarrow J/\psi D^0 \pi^+$  [11]. Four-body decays such as  $B \rightarrow J/\psi D\pi\pi$  should be extremely suppressed by the small phase space available near the kinematical limit. The remaining untested final state is  $J/\psi D$ . Calculations by Eilam *et al.* using perturbative QCD [12] predict branching fractions (BF's) for  $B \rightarrow J/\psi D$  decays on the order of  $10^{-8} - 10^{-7}$ . The observation of a signal with a BF significantly larger would suggest the presence of intrinsic charm inside the  $B$  meson.

In this Letter we report a search for decays  $B \rightarrow J/\psi D$ , with  $\bar{D}^0$  decaying to  $K^+\pi^-$ ,  $D^+$  to  $K_s^0\pi^+$ ,  $K_s^0$  to  $\pi^+\pi^-$ , and  $J/\psi \rightarrow \ell^+\ell^-$ , where  $\ell$  is  $e$  or  $\mu$ .

The data used in this analysis were collected with the BABAR detector at the PEP-II storage ring and comprise an integrated luminosity of  $112 \text{ fb}^{-1}$  taken at the  $\Upsilon(4S)$  resonance. The BABAR detector is described in detail elsewhere [13]. A five-layer, double-sided silicon vertex tracker (SVT) surrounds the interaction point and provides precise reconstruction of track angles and  $B$ -decay vertices. A 40-layer drift chamber (DCH) provides measurements of the transverse momenta of charged particles. An internally reflecting ring-imaging Cherenkov detector (DIRC) is used for particle identification. A CsI(Tl) crystal electromagnetic calorimeter (EMC) detects photons and electrons. The calorimeter is surrounded by a solenoidal magnet providing a 1.5-T field. The flux return is instrumented with resistive plate chambers used for muon and neutral-hadron identification.

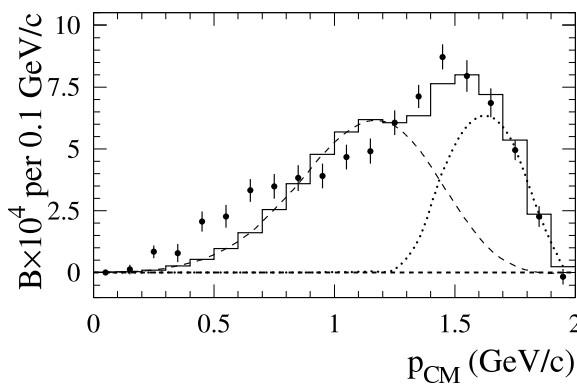


FIG. 1: Upsilon(4S) rest-frame momentum of  $J/\psi$  mesons produced in  $B$  decays, after subtracting feed-down from  $\chi_{c1,2} \rightarrow J/\psi \gamma$  and  $\psi(2S) \rightarrow J/\psi \pi\pi$  (points) [2]. The histogram is the sum of the color-octet component from a NRQCD calculation [3] (dashed line), which includes multi-body final states, and the color-singlet  $J/\psi K^{(*)}$  component (dotted line). The normalization of the curves has been constrained to fit the data.

We select multihadron events by demanding a minimum of three reconstructed charged tracks in the polar angle range  $0.41 < \theta_{lab} < 2.54$  rad. A charged track must be reconstructed in the DCH, and, except for the reconstruction of  $K_s^0 \rightarrow \pi^+\pi^-$ , it must originate at the nominal interaction point to within 1.5 cm in the plane transverse to the beam and to within 10 cm along the beam. Events are required to have an  $\Upsilon(4S)$  production point within 0.5 cm of the average position of the interaction point in the plane transverse to the beamline, and within 6 cm longitudinally. Neutral clusters are defined as electromagnetic depositions in the calorimeter in the polar angle range  $0.410 < \theta_{lab} < 2.409$  rad that are not associated with charged tracks and that have an energy greater than 30 MeV and a shower shape consistent with a photon interaction. We require the total energy for charged tracks and photon candidates in the fiducial region to be greater than 4.5 GeV. To reduce continuum  $e^+e^- \rightarrow q\bar{q}$  background, we require the ratio of second-to-zeroth Fox-Wolfram moments  $R_2$  [14] of the event, calculated with both charged tracks and neutral clusters, to be less than 0.5. Charged tracks are required to be in regions of polar angle for which the particle identification (PID) efficiency is well measured. For electrons, muons, and kaons the acceptable ranges are 0.40 to 2.40, 0.30 to 2.70, and 0.45 to 2.50 rad, respectively.

We further select signal events as described in the following. Event selection is optimized by maximizing the sensitivity  $s \equiv \epsilon/(a/2 + \sqrt{N_B})$ , where  $a = 3$  is the number of standard deviations of significance desired [15]. The maximum of this ratio is independent of the unknown signal branching fraction. The signal efficiency  $\epsilon$  after all selection requirements is estimated from simulated Monte Carlo (MC) samples. The number of background events  $N_B$ , scaled to the integrated luminosity of the data, is estimated using inclusive  $\Upsilon(4S) \rightarrow B\bar{B}$  and  $e^+e^- \rightarrow q\bar{q}$  MC samples.

We reconstruct  $J/\psi$  candidates from a pair of oppositely charged lepton candidates that form a good vertex. Muon (electron) candidates are identified with a neural-network (cut-based) selector. For  $J/\psi \rightarrow e^+e^-$  decays, electron candidates are provisionally combined with nearby photon candidates in order to recover some of the energy lost through bremsstrahlung. These bremsstrahlung-photon candidates are characterized by a deposit of more than 30 MeV in the electromagnetic calorimeter and a polar angle within 35 mrad of the electron direction, as well as an azimuthal angle either within 50 mrad of the electron direction, or between the electron direction at the origin and the azimuth of the impact point in the EMC. The lepton-pair invariant mass must be in the range [3.00, 3.14]  $\text{GeV}/c^2$  for both lepton flavors.

We form  $K_s^0$  candidates from oppositely charged tracks originating from a common vertex and having an invariant mass in the range [487, 510]  $\text{MeV}/c^2$ . The  $K_s^0$  flight

length must be greater than 1 mm, and its direction in the plane perpendicular to the beam line must be within 0.2 rad of the  $K_s^0$  momentum vector. All charged tracks are taken as pion candidates, and kaon candidates are identified with a likelihood selector based on Cherenkov-angle measurements from the DIRC and specific ionization in the SVT and in the DCH. Candidates for  $D$  mesons are formed from  $K\pi$  combinations; a requirement on the  $K\pi$  invariant mass  $m_{K\pi}$  is applied during the optimization of the selection. The analysis is then performed in a larger window  $1.80 < m_{K\pi} < 1.92 \text{ GeV}/c^2$ . The high statistics decays  $B \rightarrow J/\psi K^*$  with the same  $J/\psi K\pi$  final state are used as a control sample to evaluate the possible differences between data and MC. These are selected with requirements similar to those of the signal, except for an  $m_{K\pi}$  range of [0.79, 0.99]  $\text{GeV}/c^2$ . The  $J/\psi$  and  $K_s^0$  candidates are constrained to their nominal masses [16] to improve the resolution of the measurement of the four-momentum of their parent- $B$  candidate.

Candidate  $B$  mesons are formed from  $J/\psi$  and  $D$  candidates. Two kinematic variables are used to further remove incorrectly reconstructed  $B$  candidates. The first is the difference  $\Delta E \equiv E_B^* - E_{beam}^*$  between the  $B$ -candidate energy and the beam energy in the  $\Upsilon(4S)$  rest frame. In the absence of experimental effects, correctly reconstructed signal candidates have  $\Delta E = 0$ . The  $\Delta E$  resolution is 7.5 MeV. For the signal region,  $\Delta E$  is required to be in the range  $[-15, +12]$  MeV. The second variable is the energy-substituted mass  $m_{ES} \equiv (E_{beam}^{*2} - p_B^{*2})^{1/2}$ , where  $p_B^*$  is the momentum of the  $B$  candidate in the  $\Upsilon(4S)$  rest frame. The energy substituted mass  $m_{ES}$  peaks at the nominal  $B$  mass of  $5.279 \text{ GeV}/c^2$  for the signal. Its typical resolution is  $2.5 \text{ MeV}/c^2$ . A requirement of  $5.274 < m_{ES} < 5.284 \text{ GeV}/c^2$  was obtained in the optimization of the signal selection. The analysis is then performed in the window  $5.2 < m_{ES} < 5.3 \text{ GeV}/c^2$ . If more than one  $B$  candidate is found in an event, the one having the smallest  $|\Delta E|$  is retained.

Non- $D$   $B \rightarrow J/\psi K\pi$  decays that have  $m_{ES}$ ,  $\Delta E$ , and  $m_{\ell^+\ell^-}$  distributions similar to those of the signal are found to be the dominant contribution to the remaining background after selection cuts are applied. Signal events can be separated from non- $D$  events by their peaking at the  $D$  invariant mass in the  $m_{K\pi}$  spectrum. In MC samples, this spectrum shows a small but significant number of true  $D$  mesons: a  $D$  meson from the decay of one  $B$  was combined with a  $J/\psi$  meson from the decay of the other  $B$ . We subtract this combinatorial background using the  $m_{ES}$  distribution: the  $m_{K\pi}$  distribution of the events in the sideband ( $5.21 < m_{ES} < 5.27 \text{ GeV}/c^2$ ) is subtracted from the distribution of the events in the signal region, with a scaling factor  $R$  that is the ratio of the combinatorial background in the signal region and in the sideband. The value of  $R$  is obtained from the integrals of the ARGUS shape [17] in fits of the  $m_{ES}$  distribution with a Gaussian function for the signal and an ARGUS shape

for the combinatorial background (Fig. 2). The  $m_{ES}$  signal window for the data is shifted by  $+0.6$  MeV/c $^2$  with respect to MC after such a shift is observed on the  $J/\psi K^*$  control sample. We obtain  $R = 0.093 \pm 0.011$  and  $R = 0.131 \pm 0.038$  for  $J/\psi \bar{D}^0$  and  $J/\psi D^+$ , respectively.

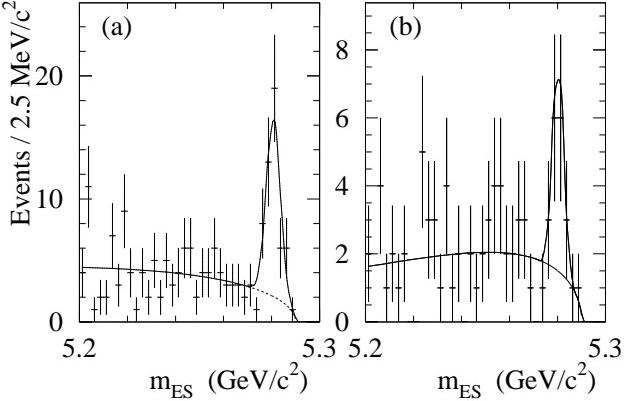


FIG. 2: Distribution of  $m_{ES}$  for data events with  $m_{K\pi}$  in the range  $[1.8, 1.92]$  GeV/c $^2$ . (a):  $J/\psi \bar{D}^0$ , (b):  $J/\psi D^+$ . The fits are described in the text. The peaks at the nominal  $B$  mass are due to non- $D$  events.

The combinatorial-background-subtracted  $m_{K\pi}$  distributions (Fig. 3) are fitted with the combination of a linear background (two free parameters) and a Gaussian signal in which the number of signal events  $S$  is a free parameter. The central value and the resolution of the  $D$  peak

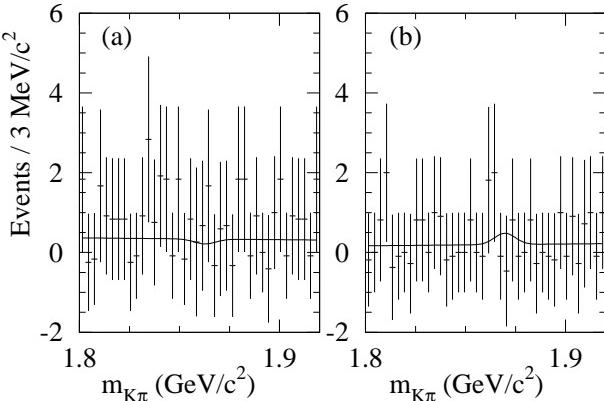


FIG. 3: Background-subtracted  $m_{K\pi}$  distributions. ((a)):  $J/\psi \bar{D}^0$ , (b):  $J/\psi D^+$ ) The fits are described in the text.

are fixed in the fit. The resolution measured on the signal MC sample is used. The agreement of data and MC samples has been studied with a  $D$ -meson control sample obtained with the same selection as for the  $D$  candidates of the  $J/\psi D$  events. The resolutions are found to be similar in the data and in the MC samples, and a shift of  $-0.6 \pm 0.2$  MeV/c $^2$  of the central value is observed and accounted for.

No significant signal for  $B \rightarrow J/\psi D$  is observed. The numbers of events obtained are  $-0.6 \pm 1.2 \pm 0.2$  ( $J/\psi \bar{D}^0$ ) and  $1.2 \pm 1.9 \pm 0.2$  ( $J/\psi D^+$ ), where the first uncertainty is statistical, and the second one is the systematic contribution due to the uncertainties in the scaling factor for background subtraction, and of the  $D$  mass and mass resolution used in the fit. The branching fractions are:

$$\mathcal{B} = \frac{S}{N_{evt} \times \epsilon \times b}, \quad (1)$$

where  $S$  is the number of signal events obtained from the fit,  $N_{evt} = 124 \times 10^6$  is the number of  $B\bar{B}$  events in the data sample, and  $b$  is the product of the branching fractions of the secondary decays (Table I).

TABLE I: Number of signal events, efficiency, secondary branching fraction, measured branching fraction ( $\mathcal{B}$ ) and upper limit (UL) at 90% C.L.

	$S$	$\epsilon$ (%)	$b$ ( $10^{-3}$ )	$\mathcal{B}$ ( $10^{-5}$ )	UL ( $10^{-5}$ )
$J/\psi \bar{D}^0$	$-0.6 \pm 1.2$	$23.3 \pm 0.3$	4.49	$-0.46 \pm 0.93$	1.3
$J/\psi D^+$	$1.2 \pm 1.9$	$22.6 \pm 0.2$	1.15	$3.7 \pm 5.9$	12.3

Additional contributions to the systematic uncertainty of the branching fraction are described in the following. The relative uncertainty in the number of  $B\bar{B}$  events is 1.1%. The secondary branching fractions and their uncertainties are taken from PDG [16]. Other estimated uncertainties are from tracking efficiency (1.3% per track added linearly),  $K_S^0$  reconstruction (2.5%), PID efficiency (3.0%) and the statistical uncertainty in the selection efficiency. The uncertainty in the selection efficiency due to the uncertainty of the MC/data difference of the central value and of the width of the peaks in  $m_{\ell^+\ell^-}$ ,  $m_{ES}$ , and  $\Delta E$  is estimated from the  $J/\psi K^*$  control sample. A summary of the multiplicative contributions to the systematics can be found in Table II. The ratio of  $B^0$  to  $B^+$  production in  $\Upsilon(4S)$  decays is assumed to be unity. The related uncertainty is small and is neglected here.

TABLE II: Summary of the contributions to the relative systematic uncertainty (%).

	$J/\psi \bar{D}^0 (K^+ \pi^-)$	$J/\psi D^+ (K_S^0 \pi^+)$
$B$ counting	1.1	1.1
Secondary BF's	2.7	6.8
Tracking	5.2	3.9
$K_S^0$	–	2.5
PID	3.0	3.0
MC statistics	1.5	1.0
Sample selection	1.0	0.8
Total	6.9	8.9

We obtain upper bounds on the branching fractions at 90% confidence level (C.L.) assuming Gaussian statistics for the statistical uncertainties and taking into account the systematic uncertainties. We have used a Bayesian method with uniform prior for positive BF values in the derivation of these limits. We obtain upper limits of  $1.3 \times 10^{-5}$  for  $B^0 \rightarrow J/\psi \bar{D}^0$  and  $1.2 \times 10^{-4}$  for  $B^+ \rightarrow J/\psi D^+$ . The results for the neutral decay are significantly lower than the amount needed to explain the excess of low momentum  $J/\psi$ 's after Chang and Hou [10]. Together with the small upper limits on the branching fraction for decays  $B \rightarrow J/\psi D\pi$  [11], we conclude that intrinsic charm as the explanation of the low momentum  $J/\psi$  excess in  $B$  decays is not supported.

We are grateful for the excellent luminosity and machine conditions provided by our PEP-II colleagues, and for the substantial dedicated effort from the computing organizations that support *BABAR*. The collaborating institutions wish to thank SLAC for its support and kind hospitality. This work is supported by DOE and NSF (USA), NSERC (Canada), IHEP (China), CEA and CNRS-IN2P3 (France), BMBF and DFG (Germany), INFN (Italy), FOM (The Netherlands), NFR (Norway), MIST (Russia), and PPARC (United Kingdom). Individuals have received support from CONACyT (Mexico), A. P. Sloan Foundation, Research Corporation, and Alexander von Humboldt Foundation.

---

- [1] R. Balest *et al.* [CLEO Collaboration], Phys. Rev. D **52**, 2661 (1995); S. Chen *et al.*, Phys. Rev. D **63**, 031102 (2001).
- [2] B. Aubert *et al.* [BABAR Collaboration], Phys. Rev. D **67**, 032002 (2003).
- [3] M. Beneke, G. A. Schuler and S. Wolf, Phys. Rev. D **62**, 034004 (2000).
- [4] S. J. Brodsky and F. S. Navarra, Phys. Lett. B **411** (1997) 152.
- [5] Charge-conjugate modes are included implicitly throughout this paper.
- [6] B. Aubert *et al.* [BABAR Collaboration], Phys. Rev. Lett. **90**, 231801 (2003).
- [7] C.T.H Davies and S.H.H Tye, Phys.Lett. **B154** 332 (1985).
- [8] C. K. Chua, W. S. Hou and G. G. Wong, Phys. Rev. D **68**, 054012 (2003).
- [9] S. J. Brodsky, P. Hoyer, C. Peterson and N. Sakai, Phys. Lett. B **93** (1980) 451.
- [10] C. H. Chang and W. S. Hou, Phys. Rev. D **64** (2001) 071501.
- [11] B. Aubert *et al.* [BABAR Collaboration], hep-ex/0406022.
- [12] G. Eilam, M. Ladisa and Y. D. Yang, Phys. Rev. D **65** (2002) 037504.
- [13] B. Aubert *et al.* [BABAR Collaboration], Nucl. Instrum. Meth. A **479**, 1 (2002).
- [14] G. C. Fox and S. Wolfram, Phys. Rev. Lett. **41**, 1581 (1978).
- [15] G. Punzi, eConf **C030908** (2003) MODT002 [arXiv:physics/0308063].
- [16] Particle Data Group, S. Eidelman *et al.*, Phys. Lett. B **592**, 1 (2004).
- [17] H. Albrecht *et al.*, [ARGUS Collaboration], Z. Phys. C **48**, 543 (1990).

\* Also with Università della Basilicata, Potenza, Italy

† Deceased